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PCT200 SERIES
CT/PT TEST SYSTEM USER MANUAL

VERSION: **PCT200 SERIES-AE-1.00**

DATE: **26/06/2012**

This manual represents the technical status for the moment of publishing. The product information, description and specifications mentioned in the manual do not have any contact binding force and PONOVO POWER CO., LTD remains the right to make modifications to the technical specifications and configurations without prior notice. PONOVO POWER PONOVO explicitly exonerates itself from all liability for mistakes in this manual

Notes：

- **In order to prevent static electricity, the PCT and test CT must be connected to ground safely before test.**
- **Avoid electric shock accident when the output voltage is above 36V.**
- **Short circuit is prohibited at output side while testing.**
- **Connect wires in accordance with instructions.**
- **External voltages and currents are prohibited to apply on the tester's output.**
- **Avoid the equipment being wet by rain.**
- **Contact manufacturer timely and do not repair it when device works abnormally.**

Special Tips:

1. CT/PT testing system (called PCT) is applied in the electromagnetic current transformer (CT) and electromagnetic voltage transformer (PT) of power system. It completes the following test items:

- CT load impedance
- CT secondary coil resistance (Rct)
- CT excitation characteristic
- CT ratio
- CT polarity
- PT ratio and polarity
- PT excitation characteristic

……

PCT is only used in the above fields and the wiring connection/ operations should be executed in the guide of the user manual. Any other usage is invalid. The users must operate PCT in the proper way. Otherwise, improper operation might cause damage. The manufacturer will not take any responsibility for such damages. The users assume all responsibilities and risks.

2. The power supply must be accordance with the requirements described in user manual.
3. Users can't maintain the PCT without manufacturer's authorization. Otherwise the warranty period is invalid.
4. Users can't disassemble the PCT without manufacturer's authorization. Otherwise the warranty period is invalid.

5. It is prohibited to maintain reform, extend or change the system or any other accessories.
6. Only original accessories are accepted in test and detection process.
7. It is not allowed to connect or disconnect the test object in the operation process. The high voltage caused by energy, storing in external inductance, might damage the human, PCT and test object.
8. Make sure that the terminals of the test objects are not charging to exit the program.
9. Please make wiring connection in the guide of user manual while making CT test. If the wiring is wrong, the high voltage might damage the CT or PCT.
10. Please make wiring connection in the guide of user manual while making PT ratio and polarity test. If the users connect the PCT output with the secondary side of PT, thousands of volts high voltage might be generated in the primary side and damage the PT or PCT.
11. Please make wiring connection in the guide of user manual while making PT excitation test. The PCT output must be connected with the secondary side of PT. If it is connected with the primary side of PT, it might damage the PT or PCT.
12. The data and parameters in the nameplate are only for reference. PONOVO explicitly exonerates itself from all liability for mistakes in this manual.

Content

1. General Description

1.1 Functions

		PCT200Li	PCT200i	PCT200Ai	PCT200Mi
CT	CT type	P	P, TP, M	P, TP, M(0.2S)	P, M(0.2S)
	Ratio, polarity	◆	◆	◆	◆
	Coarse ratio	◆	◆	◆	/
	Guess ratio	◆	◆	◆	/
	Turn-ratio and error	/	◆	◆	◆
	Ratio error and phase displacement	◆ (100%)	◆	◆	◆
	Rct	◆	◆	◆	◆
	Burden	◆	◆	◆	◆
	Excitation characteristic	◆	◆	◆	/
	CT demagnetization	◆	◆	◆	◆
	Knee point (V-I)	◆	◆	◆	/
	Remanence flux (Kr)	/	◆	◆	/
	Secondary time constant (Ts)	◆	◆	◆	/
	Unsaturated inductance (Lu)	◆	◆	◆	/
	Saturated inductance (Ls)	/	◆	◆	/
	Safety factor (FS)	/	◆	◆	◆
	Accuracy limit factor (ALF)	◆	◆	◆	/
	Composite error (εc)	/	◆	◆	/

	Eal	/	◆	◆	/
	Transient area factor (Ktd)	/	◆	◆	/
	Rated symmetrical short-circuit current ratio (Kssc)	/	◆	◆	/
	Peak instantaneous error $\hat{\varepsilon}$	/	◆	◆	/
	Guess nameplate	◆	◆	◆	Assessment
	Report tools	◆	◆	◆	◆
PT	Ratio	◆	◆	◆	/
	Polarity	◆	◆	◆	/
	Excitation characteristic	/	◆	◆	/

Notes: The symbol "◆" indicates it has the function.
The symbol "/" indicates there it doesn't have the function.

1.2 Technical Specifications

Items		PCT200Li	PCT200i	PCT200Ai	PCT200Mi
Output voltage range		0-120V			
Output current range		0-5Arms (15A peak)			
Output power		0.001-500VArms (1500VA peak)			
T type CT	Ratio test range	5000:1, 5000:5	35000:-45000:5	35000:-45000:5	35000:-45000:5
	Ratio test accuracy	1-5000 0.10%Typ. 0.20% Gur	1-2,000 0.05%Typ. 0.10%Gur 2,000-5,000,0.08%Typ.0.15%Gur 5,000-30,0000, 0.10%Typ. 0.20%Gur	1-2,000 0.02%Typ. 0.05%Gur 2,000-5,000,0.03%Typ0.10% Gur 5,000-30,0000, 0.05%Typ. 0.20%Gur	1-2,000 0.02%Typ. 0.05%Gur 2,000-5,000.03%Typ.0.10%Gur 5,000-30,000, 0.05%Typ. 0.20%Gur
	Max. knee point voltage	5,000V	45,000V	45,000V	/
	Burden test accuracy	±0.1%±1mΩ	±0.05%±1mΩ Typ. ±0.1%±1mΩ Gur.		
	Winding resistance test accuracy	±0.1%±1mΩ	±0.05%±1mΩ Typ. ±0.1%±1mΩ Gur.		
M type CT	Ratio error		±0.10%Typ.±0.20% Gur	±0.05%Typ. ±0.10%Gur	±0.02%Typ. ±0.05%Gur
	Phase displaceme		5min Typ. 10min Gur.	1min Typ. 3min Gur. 0.01min	1min Typ. 2min Gur. 0.01min

	nt		0.1min		
Main supply	110-240Vac/50-60Hz(Nominal) 90-260Vac/45-65Hz (Permissible)				
Operation temperature	-10℃～50℃				
Relative humidity	≤90%, non-condensing				
Dimensions	470x200x245mm (WxHxL)				
Weight	11kg				
LCD display	8.4 inch, color display				
Operating system	Windows				

1.3 Features

- Apply the newest principle of multi point DC method and meet the standards of IEC 44-6 and GB 16847.
- Measure ratio differential and angle differential accurately. The max ratio differential error is ±0.1%, max angle differential error ±3min and the ratio measurement range is 1~35,000.
- Calibration certificate approved by Wuhan High Voltage Institute. The report includes: angle differential, ratio differential test and stability test.
- 8.4 inch LCD with colorful graphical interface for HMI.
- The whole integration structure, anti-vibration and anti-electromagnetic interference combination chassis.
- Built-in computer for operation. All test items are completed automatically.
- Light weight and small dimension due to small voltage and power output.
- Built-in linear amplifier for quick response and high accurate. The max output AC voltage is 120V and max output current is 5Arms (15A peak value).
- The voltage measurement method is used to test CT.
- The highest test knee point voltage of CT is about 45,000V. And the excitation characteristic test speed is fast. These features surpass that of traditional analyzer.
- Apply to various types of CT (including TP type) excitation, ratio, polarity, secondary winding resistance, load, ratio differential and angle differential etc steady-state or transient characteristic test.
- Automatically test knee point voltage/ current, 5%/ 10% error curve, ALF, FS, Ts, and Kr etc CT parameters.
- Users can select ten groups of excitation data to save.
- It lists the ratio error and phase error table and changes the report data in condition the rated current 1%-300% be set.
- The PCT automatically memories test items, report items, and report setting items.
- The report can be converted into EXCEL format in PC. More than thousands of reports are saved in it for checking and printing.
- Users can export the test results by U disk as well as upgrade.
- The report tool software is convenient for report saving, converting and analyzing which is for

data contrast, judgment and assessment.

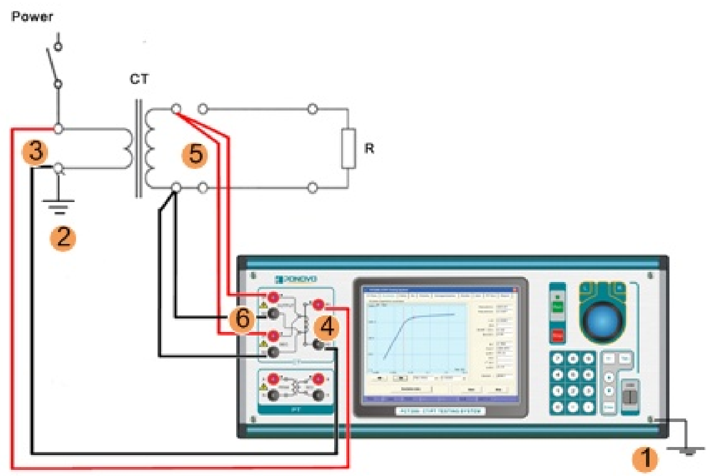
- User-defined test according to the defined standards.
- PT test items: ratio, polarity and volt-ampere characteristic.

1.4 Operation Preparation

Preparation:

CT secondary side load loop disconnection and secondary winding off-grounded
CT primary side disconnects with busbar

Order of connection:



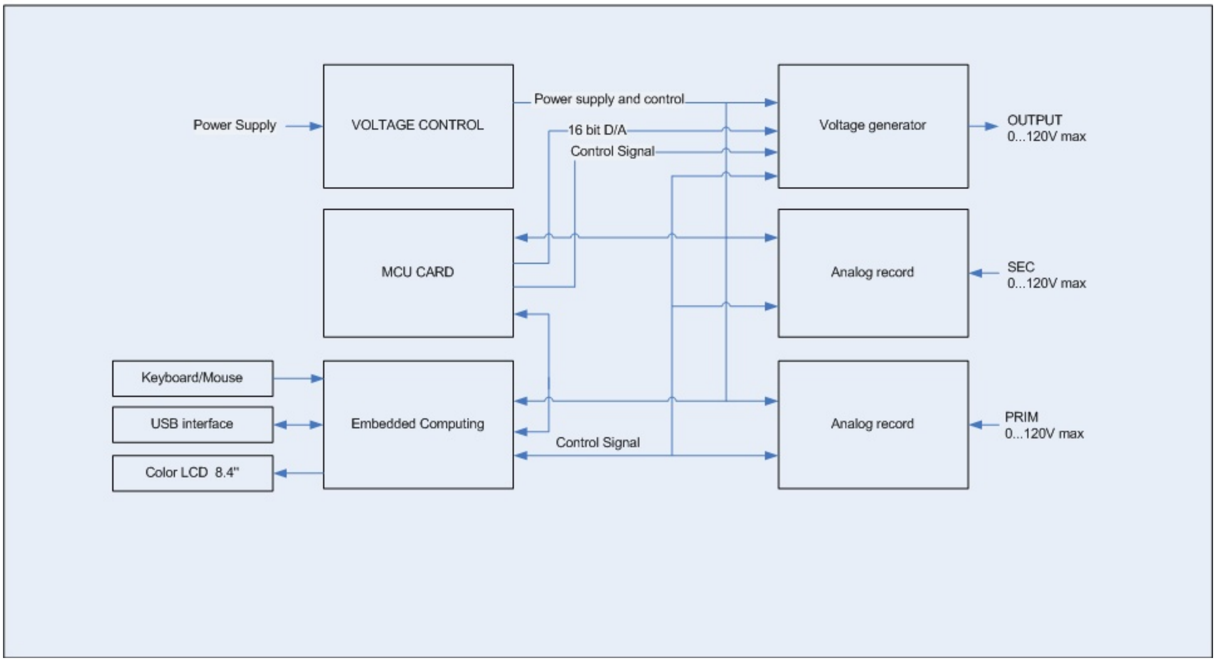
1. The chassis of PCT is grounded.
2. One end of CT primary side grounded (P2)

Note: There is a grounding switch in one side of primary. No matter the grounding switch is in P1 or P2, only one end is supposed to ground.

3. The test lead connects with P1, P2 of CT.
4. The other end of the lead connects with P1, P2 of PCT200i.
5. One secondary side connects with one group of CT's S1 and S2
6. The other Secondary side connects with S1, S2 of PCT200i.
7. Power on

1.5 Block Diagram

Serial PCT200i Diagram



2. Panel Description

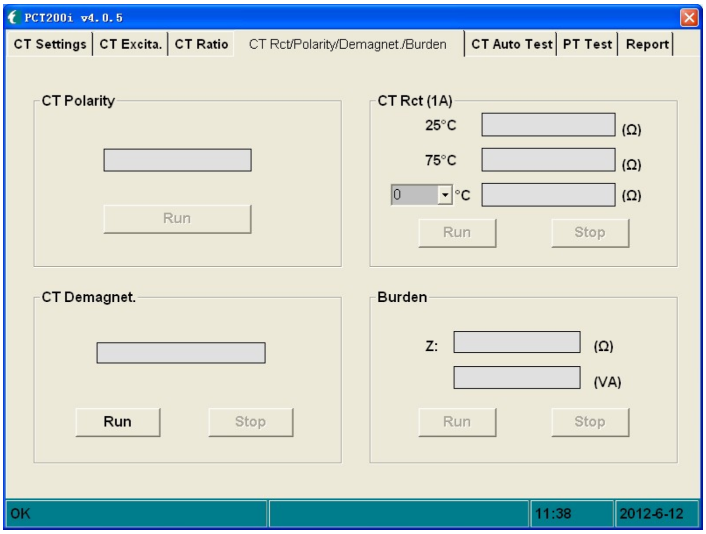


1) Connecting CT secondary side
2) Secondary side voltage test while testing CT/PT (PT Excitation only)
3) Primary side voltage test while testing CT
4) Connecting PT primary side
5) Secondary side voltage test while testing PT
6) Run lamp: output indicator--flashing while outputting
7) Rotary encoder: selecting menu and setting specifications
8) Run and stop buttons
9) Keyboard
10) USB interface
11) LCD display

3. Operation Instruction

3.1 Select Test Functions

Choosing main menu button at any interface to enter, then rotating rotary encoder to change the cursor position and select specified testing button. The selected operation is displayed in the below.



3.2 Set Test Parameters

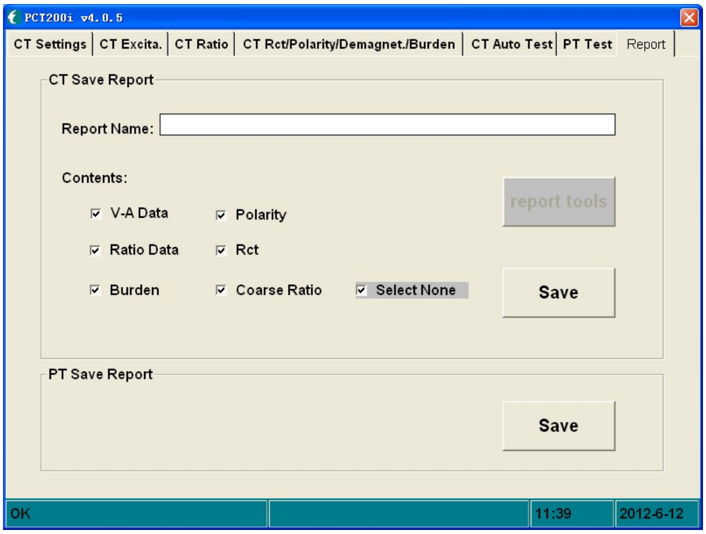
Set variable parameters by pushing keyboard and pressing mouse.

3.3 Control Output

The run and stop buttons on the panel or the start test and stop test functions can control the output. While output, the operation indicator will flash.

3.4 Save Test Report

After testing, select the report menu and enter into report save interface. The report name is put in by keyboard and the content is selected by mouse selection. The report is saved automatically in the CT report file. The report can be copied and converted into EXCEL format in PC by U disk.



There are two ways to view test reports locally.

One is to view the test results in **Report tools**. The other way is to view in EXCEL format in PC.

The following is sample test report, A4.

PCT200i Report			
Report:	North Klang Straits SS	CT SN:	0
CT Type:	Class 0.5	Date:	2010-3-10 0:00

Settings			
CT Type:	P	Frequency :	50HZ
Power Factor :	0.8	Primary Current (A):	1200
Secondary Current (A):	1	Rated Burden(VA):	15
CT Temperature (C°):	25	Winding:	1S1 1S2
Standard:	60044-1	ALF:	5P
Composite Error:	5P		

Results			
Excitation			
Knee Point(V):	56.49		
Knee Point(A):	0.01009		
Ts:	1.1651		
Kr:	0.5694		
Lu:	16.6		
Ls:	0.36		
Composite Error:			
Rated Ratio:			
Ratio:	1200:0.9999		
Ratio Error (%):	-0.014		
Phase Displacement(min):	3.345		
Turn Ratio Error(%):	-0.301		
Turn Ratio:	1196.392		
Burden			
Burden(Ω):	0		

Polarity			
Polarity :	Positive		
RCT	1.883		
Rct(75C°):	2.246		

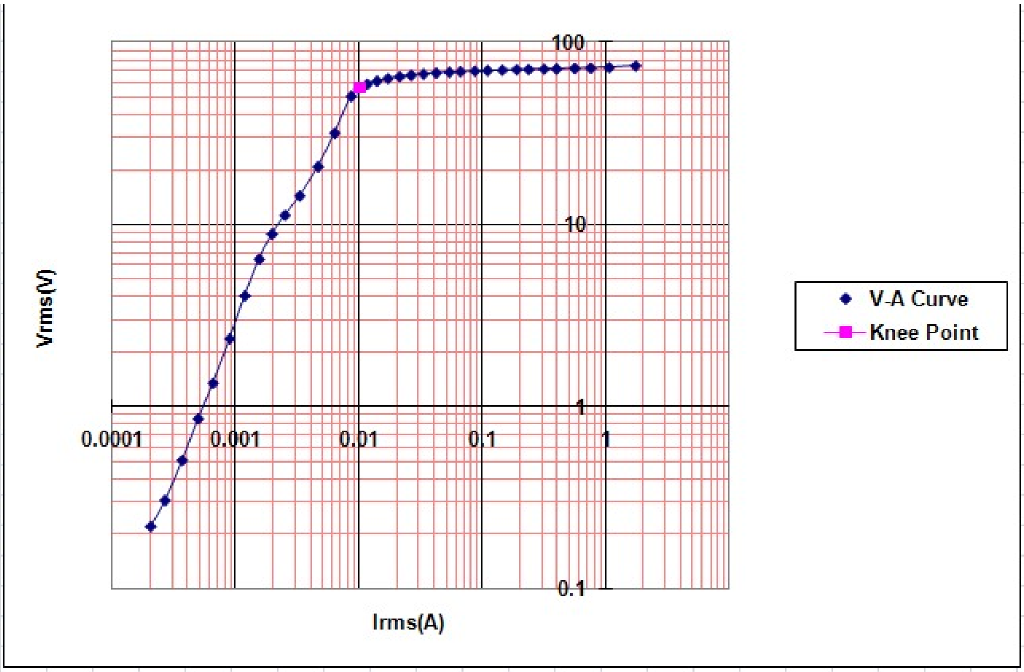
Ratio (Ipn%)										
VA	COSΦ	1%	5%	20%	100%	120%				
15	0.8				-0.01385					

Tested by:		Approved by:	

Phase Displacement(min)(Ipn%)

VA	COSΦ	1%	5%	20%	100%	120%				
15	0.8				3.3451					

Excitation Characteristic		Irms	Vrms	Irms	Vrms	Irms	Vrms
	Standard	1.7125 A	74.1968 V	0.0532 A	68.5332 V	0.0033 A	14.3357 V
		1.0474 A	72.7246 V	0.0415 A	67.8283 V	0.0025 A	11.2026 V
	60044-1	0.7407 A	72.2054 V	0.0328 A	66.97 V	0.0019 A	8.8421 V
		0.5512 A	71.8511 V	0.026 A	65.9603 V	0.0015 A	6.4353 V
		0.392 A	71.4819 V	0.021 A	64.7667 V	0.0012 A	4.0507 V
		0.311 A	71.2662 V	0.0169 A	63.149 V	0.0009 A	2.3488 V
		0.2326 A	70.9244 V	0.0138 A	61.2065 V	0.0006 A	1.34 V
		0.1864 A	70.6861 V	0.0115 A	58.8584 V	0.0005 A	0.8541 V
		0.1426 A	70.2865 V	0.0098 A	55.6582 V	0.0004 A	0.5055 V
		0.1082 A	69.8885 V	0.0085 A	50.5515 V	0.0003 A	0.304 V
		0.0854 A	69.4875 V	0.0063 A	31.7101 V	0.0002 A	0.2187 V
		0.0654 A	68.9856 V	0.0046 A	20.7487 V		
User Data							

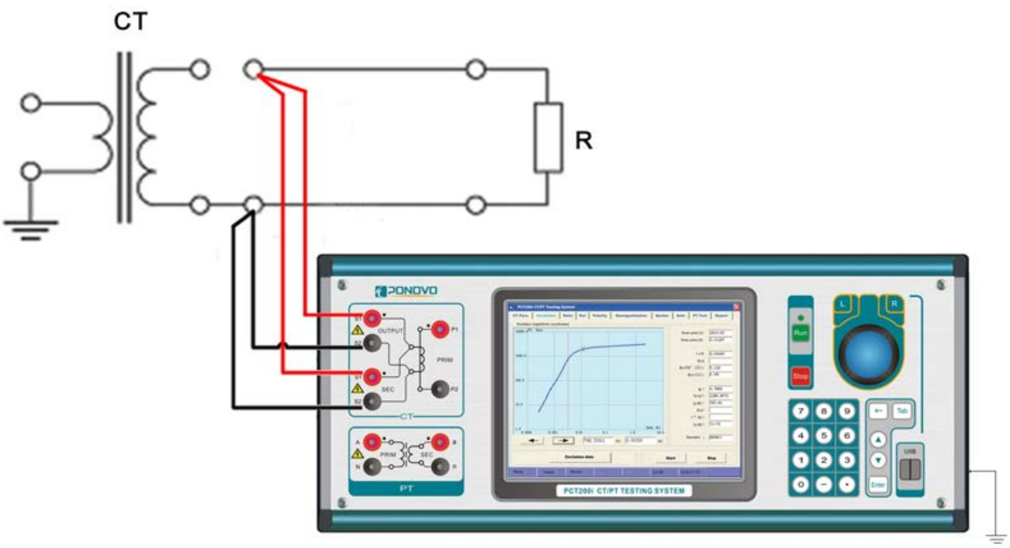


Tested by:		Approved by:	

4. Burden Test

4.1 Wiring Connection

Connecting the instrument transformer according to the below direction, while doing secondary load impedance test.

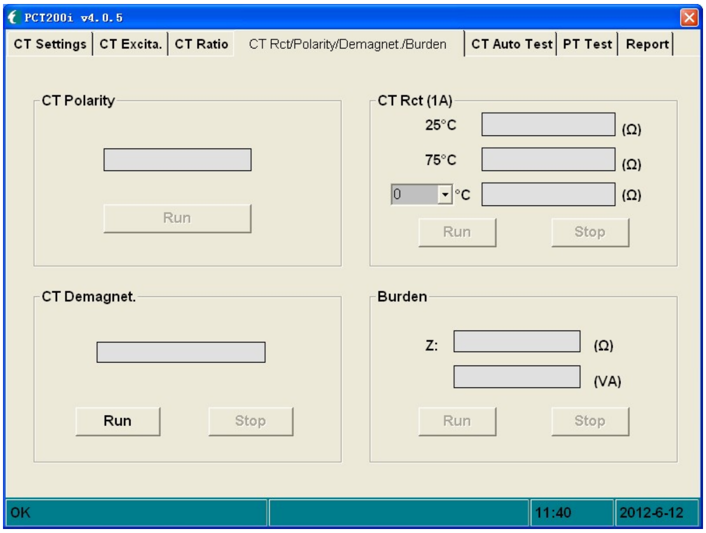


Wiring direction: The transformer's output end S1 and testing end S1 are connected with one side of secondary load the CT.

The transformer's output end S2 and testing end S2 are connected with the other side of secondary load of the CT.

4.2 Test Operation

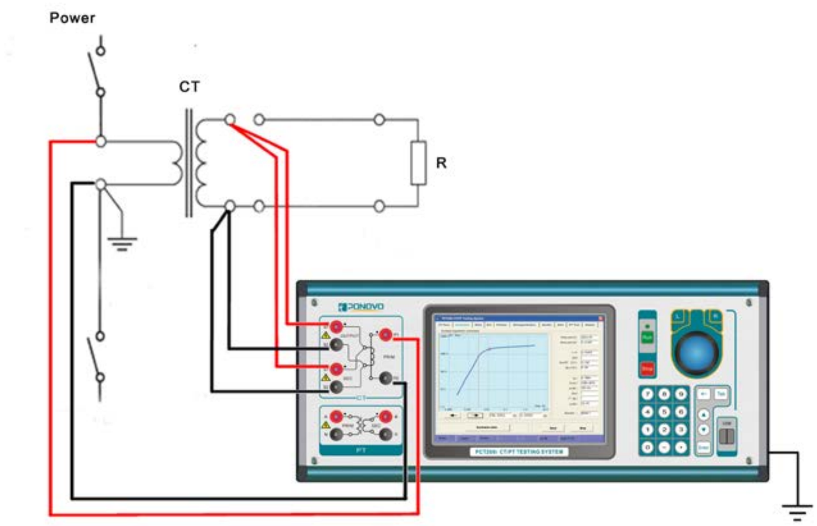
Entering the main menu and selecting the **Rct/polarity/demagnification/load impedance test** unit, CT secondary burden measuring can be done. After entering this unit and moving the mouse in the load impedance testing zone, the test software button is automatically available. The load impedance test can be finished pressing start button. The test result will be shown in the data fill bank, after testing, it stops automatically and the cursor is off.



5. CT Test

5.1 Wiring Connection

While doing the CT secondary coil resistance, polarity, excitation, demagnetization and ratio test, the instrument transformer tester should be connected according to the below diagram.



Wiring direction: The transformer's output S1 and testing side S1 are connected with one side of CT secondary.

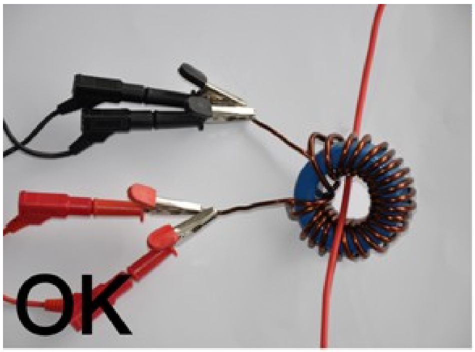
The transformer's output S2 and testing side S2 are connected with the other side of CT secondary.

The transformer's primary test side P1 is connected with one side of CT primary.

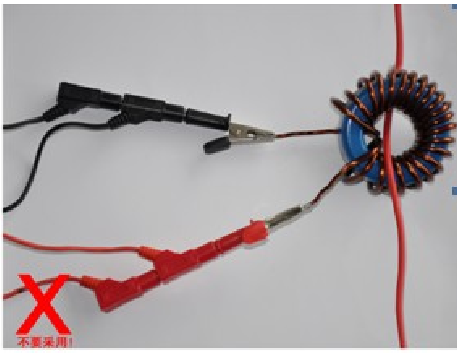
The transformer's primary test side P2 is connected with the other side of the CT primary.

The comparison between four-cable and two-cable testing:

The transformer secondary tap is connected by claps and the following four-cable connection is applied.



Four-cable connection



Two-cable connection

Otherwise, the chuck resistance might affect measuring result and the CT tester might list the incorrect measuring result.

Four-cable connection: CT output terminal and input terminal are connected with tested objects by different claps.

Every testing cable needs a clap.---CORRECT

Two-cable connection: Single testing cable is applied in CT output terminal and input terminal. But the testing cable is connected with the transformer by a public clap.

Two testing cables use a public clap.---INCORRECT

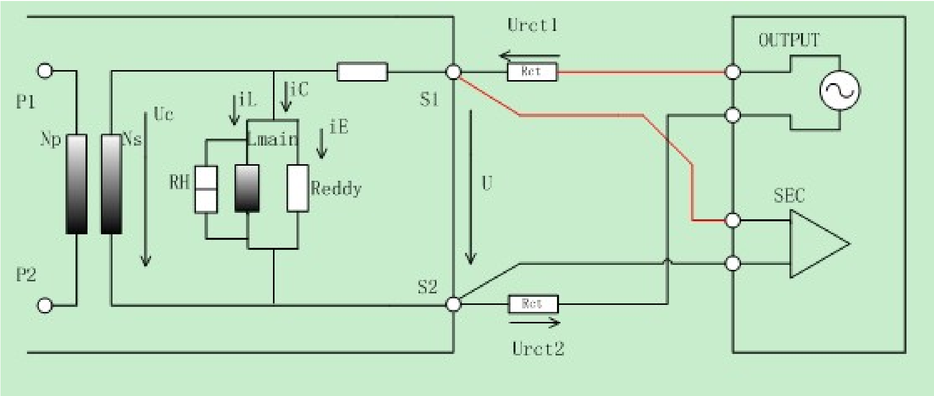
Physics background:

While two-cable is applied, if there is contact resistance in the CT clap, there will be big measuring error between the differential error and other parameters. Because the contact resistance might have change when the clap connect or disconnect with CT, the measuring result can't be repeated.

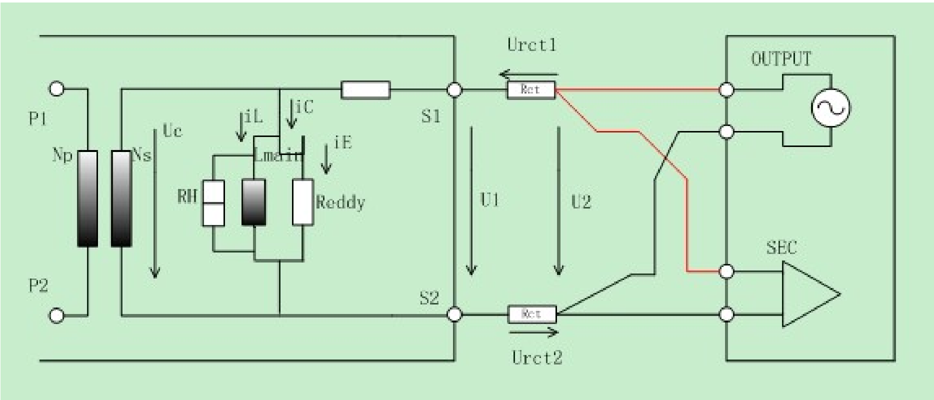
The max. contact resistance of two claps will be 0.5 and the max. overload would be 12.5VA. For this, the lower the CT coil resistance, the bigger the contact resistance's effect. When testing a 5ACT, such contact resistance might cause a completely wrong result. But if a higher resistance such as 10Ω, the error can be igored. So the four-cable conection is absolutely applied in 5ACT

testing.

Showing as the following diagram:



Four-cable connection: The testing will not be affected by voltage drop, the CT testing result is correct.



Two-cable connection: The measuring voltage includes the voltage drop that clap contact resistance generates, then the CT measuring result might be incorrect.

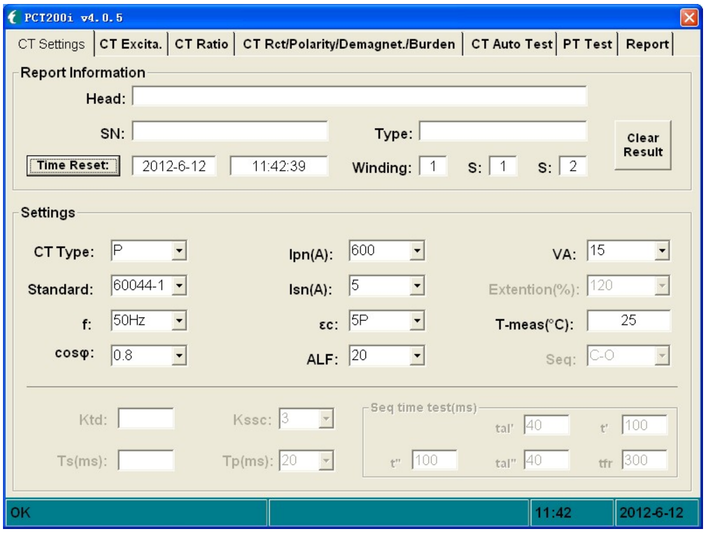
5.2 Test Operation

5.2.1 Settings

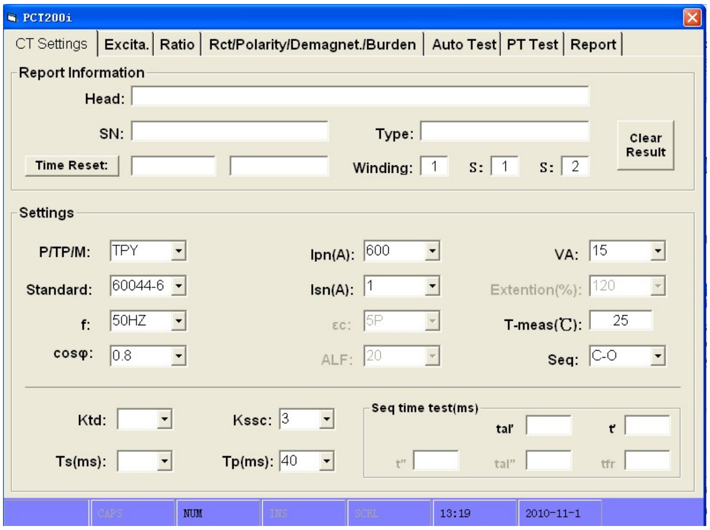
Select CT parameter setting menu after entering into main menu. The CT nameplate parameters can be set by mouse or keyboard. The testing result will be correct on condition that the settings are right.

The related parameter settings are based on the selected CT type. All the parameters can be selected in the drop-down menu or by mouse.

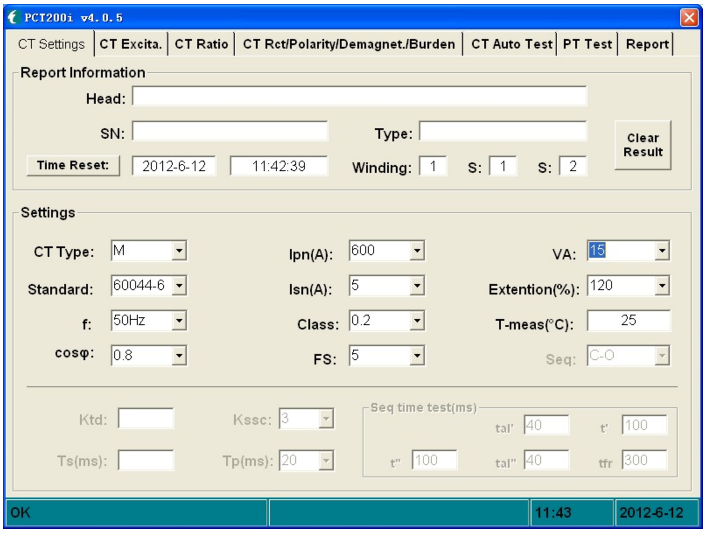
P type CT parameter setting:



TPY type CT parameter setting:

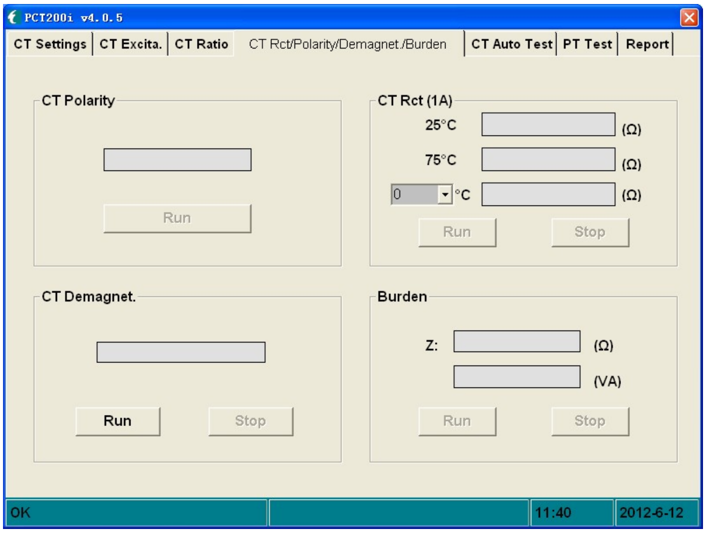


M type CT parameter setting:



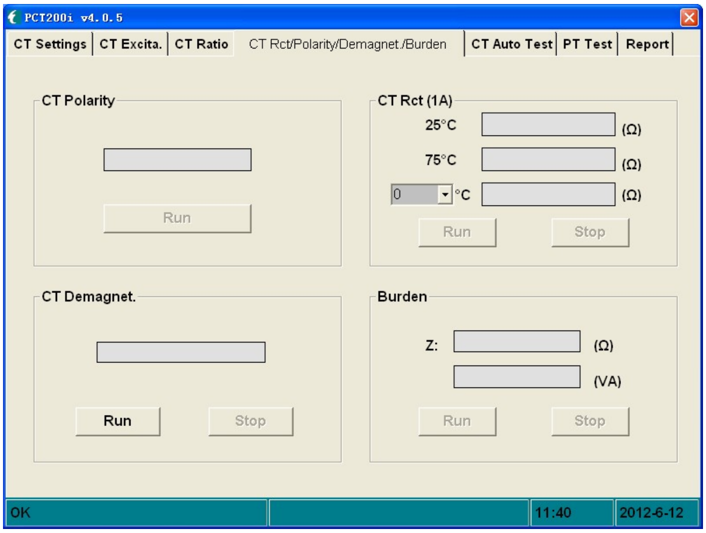
5.2.2 Rct Measuring

CT secondary winding resistance test can be done after selecting the **Rct/Polarity/Demagnet/ Burden** measuring unit. Entering the Rct measuring unit, the secondary winding Rct can run automatically after pressing the run button. The measuring result 25℃ means the resistance at current temperature and the 75℃ means the resistance at 75℃. After testing, it stops automatically and the lamp is off.



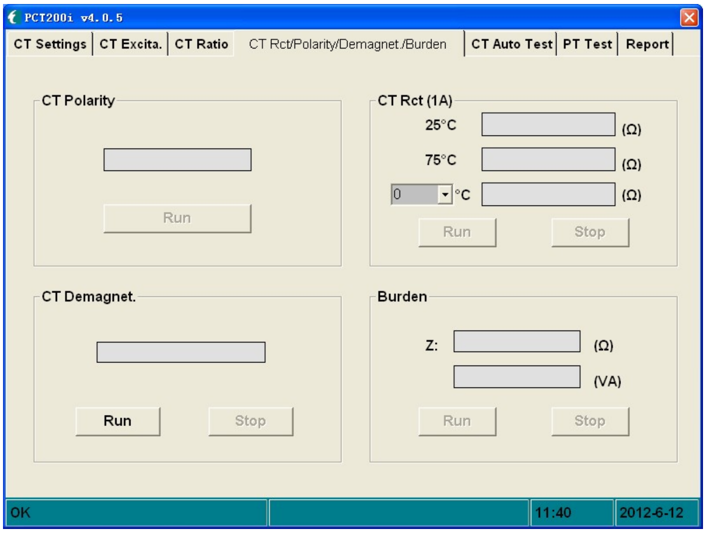
5.2.3 Demagnetization

CT demagnetization can be done after selecting the **Rct/Polarity/Demagnet/ Burden** unit. The process will automatically run when entering the unit and pushing the run button. After the process, it will automatically stop and the lamp is off.

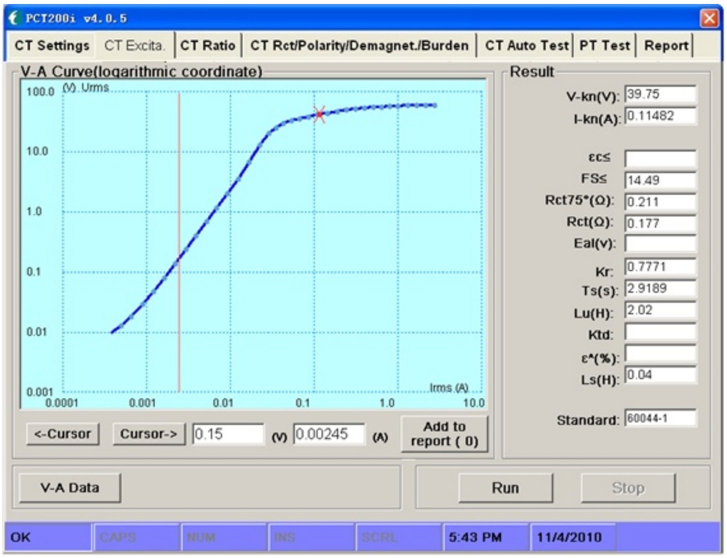


5.2.4 Polarity Test

CT polarity check can be done after selecting the **Rct/Polarity/Demagnet/ Burden** unit. The polarity test is automatically finished while pushing the run button. It stops automatically and the lamp is off. The test method is negative polar.



5.2.5 Excitation Test

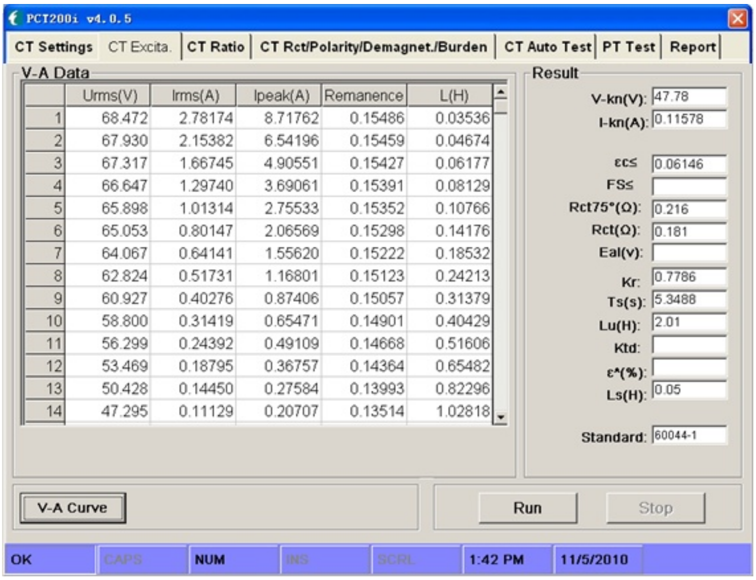


CT excitation test can be done after selecting the **Excita.** unit.
The test will automatically run while entering the **Excita.** unit. It stops automatically after test and the lamp is off.
The test result displays in curve, and the voltage and current are shown at knee point.

Red cross will be shown at the knee point.

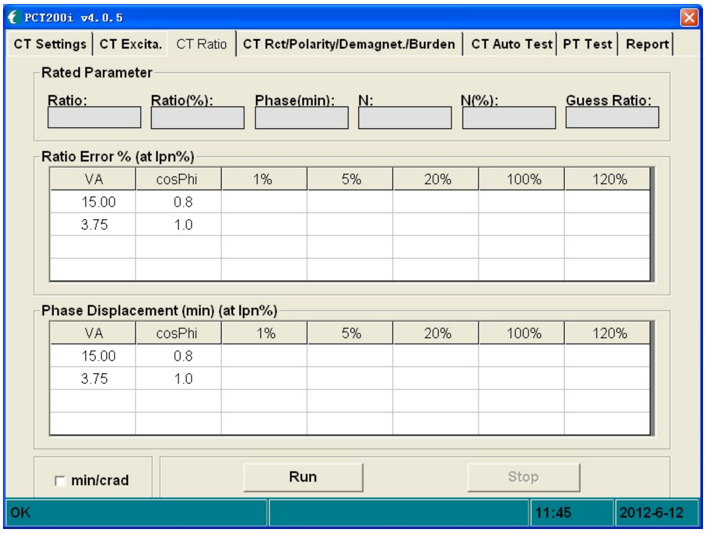
Press Cursor left, Cursor right or put in figures related to the value to observe.

Press excitation button, the excitation curve can be changed into data table pressing V-A data to check every voltage, current, magnetic flux and inductance.



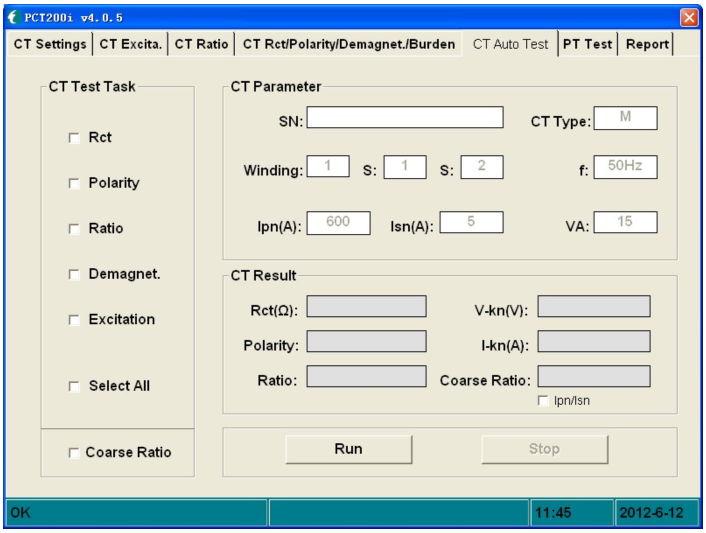
5.2.6 Ratio Test

CT ratio test can be made in Ratio test. CT ratio, differential, angle difference, composite error and turns ratio error can be automatically tested.
When the test is completed, it stops automatically and the lamp is off.



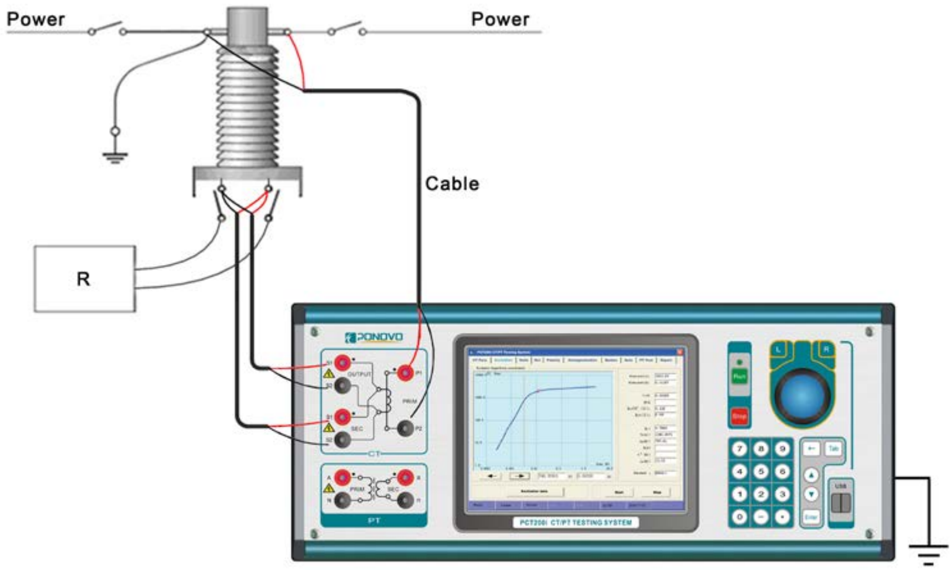
5.2.7 Auto Test

CT excitation, polarity, ratio, secondary side winding resistance and demagnetization tests all can be done after selecting auto test unit and pushing run button. When it is finished, the test automatically stops and the lamp is off. Ratio, excitation knee voltage, polarity, secondary side resistance test result can be checked in this unit. Excitation test result should be checked in excitation unit.



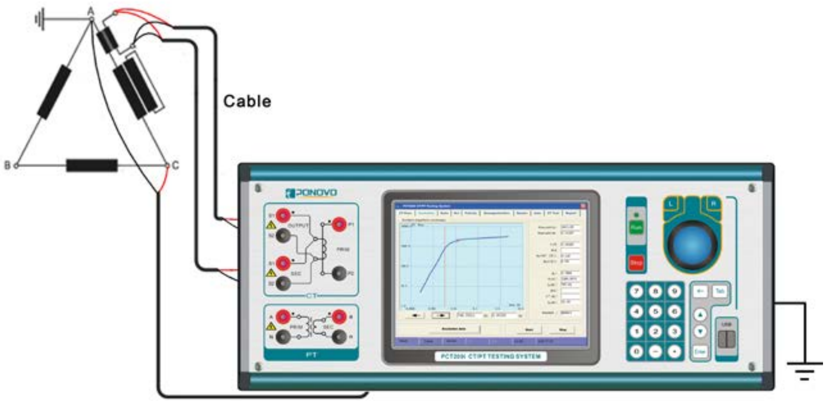
5.3 Application Examples

5.3.1 Transmission line CT Test



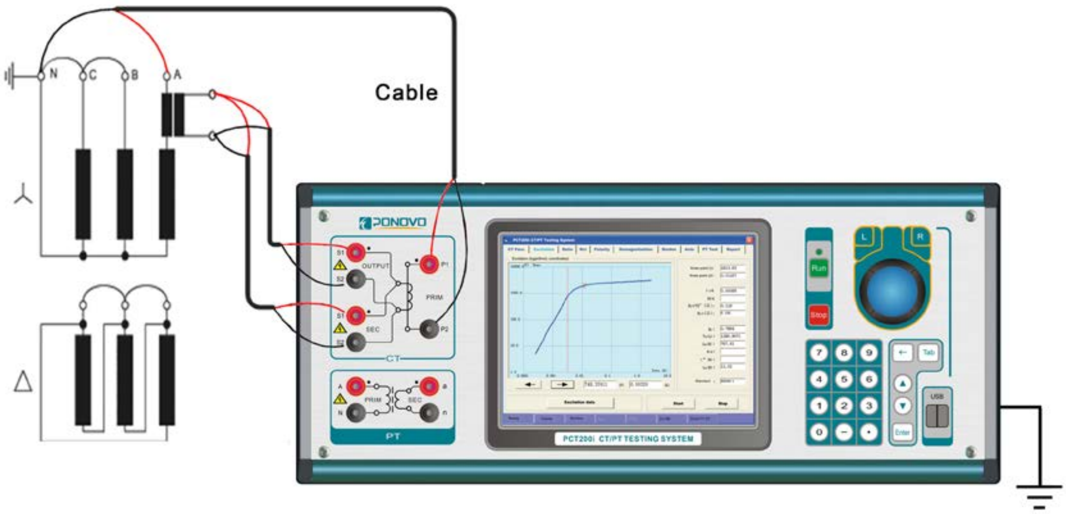
5.3.2 CT Test in Y Voltage Transformer

In order to reduce interference, other windings of the CT voltage transformer should be short circuit.



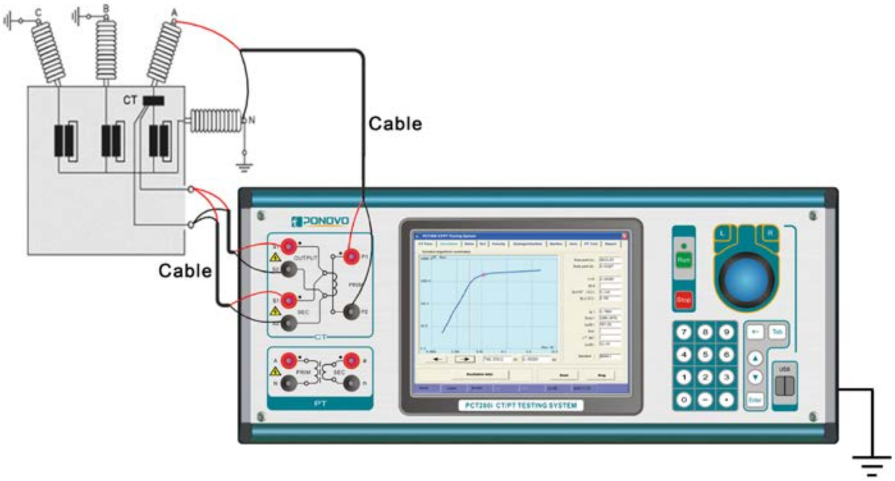
5.3.3 CT Test in the Star Connection Voltage Transformer

In order to reduce interference, other voltage transformer's windings should be short circuit.



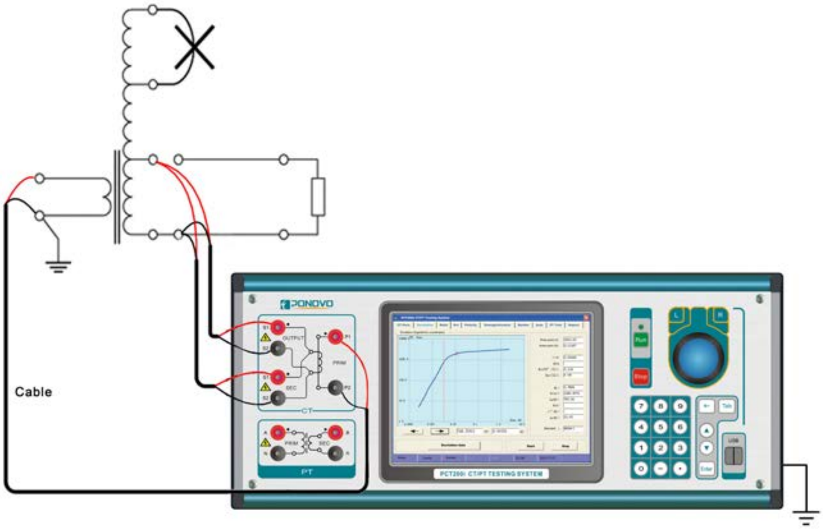
5.3.4 Bushing CT Test

In order to reduce interference, other windings of the CT voltage transformer should be short circuit.



5.3.5 Test CT with Tapping

All the windings in the same shank are all switched on while testing CT with tapping.

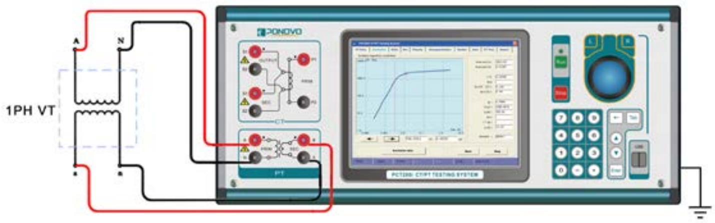


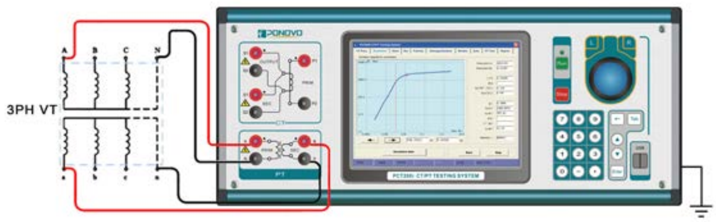
6. PT test

6.1 Wiring Connection

6.1.1 Polarity and Ratio Test

Connect instrument transformer tester as illustrated in below when doing PT polarity, ratio test.



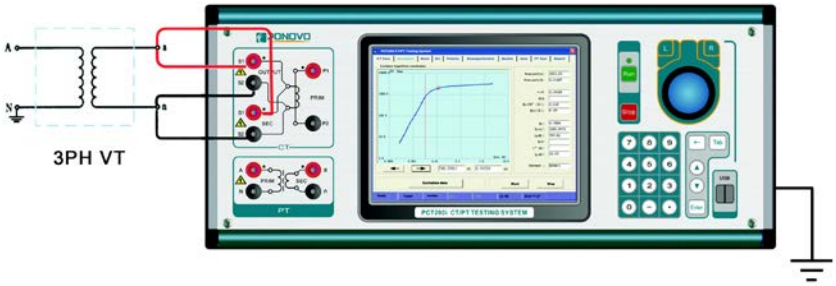


Wiring directions: The output “A” of transformer is connected with one side of PT primary.
The output “N” of transformer is connected with one side of PT primary.
The secondary testing end “a” of transformer is connected with one side of PT secondary.
The secondary testing end “n” of transformer is connected with the other end of PT secondary.

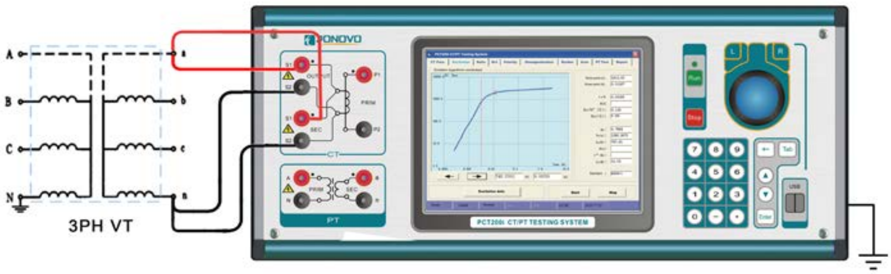
Note: The wiring for primary and secondary cannot be wrong, otherwise, it may give thousands of voltage.

6.1.2 Excitation Test

Connect transformer tester as illustrated in below when doing PT excitation test.



Single-phase voltage transformer



Three-phase voltage transformer

Wiring directions: The output S1 of transformer is connected with one side of PT secondary.

The output S1 of transformer is connected with the other side of PT secondary.

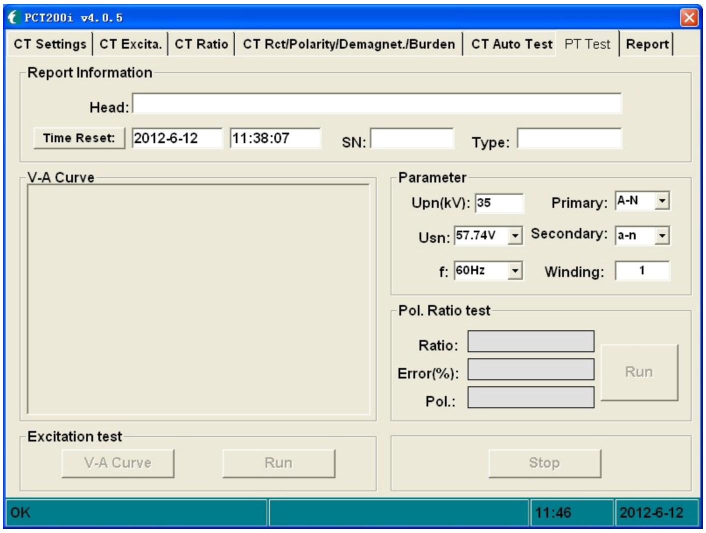
PT primary end is connected with a reliable ground, and other windings are open circuit.

Notes: Keep off the instrument, in case that thousands of voltage may occur while doing excitation test.

6.2 Test Operation

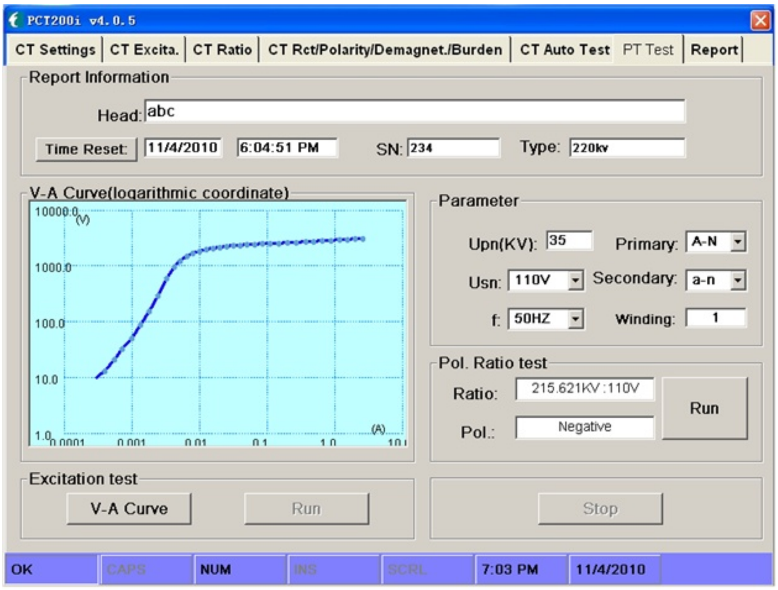
6.2.1 Settings

Set parameters according to PT nameplate.



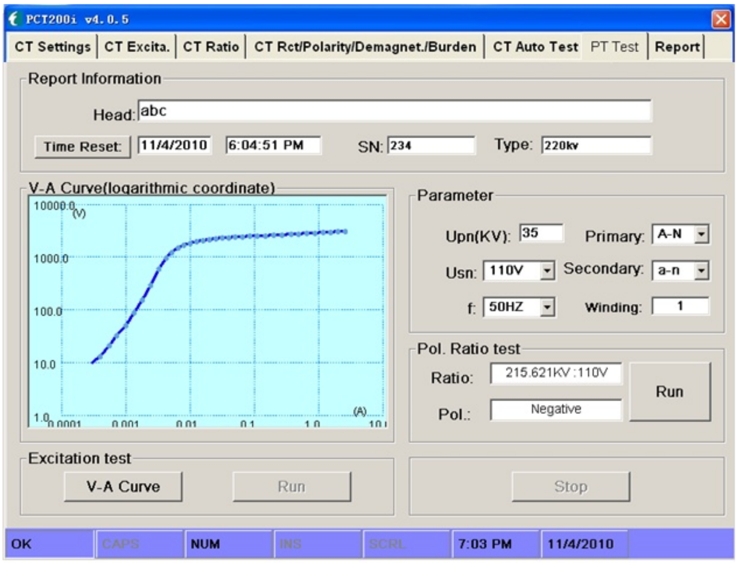
6.2.2 Polarity and Ratio Test

The PT polarity, ratio test can be automatically finished after selecting polarity ratio and pushing run button. It stops automatically and the lamp is off.



6.2.3 Excitation Test

Enter into PT test unit, and then choose excitation test.
Every voltage and current value can be checked in the excitation curve.



Press Save button to save the testing report after finished the test.

Appendix: Glossary

CT: current transformer
PT: Voltage transformer
P/TP/M: the type of CT.
P: protection current transformer class P
M: measurement current transformer
PR: protection current transformer class PR
PX: protection current transformer class PX
TPY: protection current transformer class TPY
TPX: protection current transformer class TPX
TPZ: protection current transformer class TPZ
TPS: protection current transformer class TPS
Standard: including 60044-1(IEC60044-1), 60044-6(IEC60044-6), ANSI30, ANSI45
f :frequency
cosφ:
Ipn: rated primary current
Isn: rated secondary current
εc: composite error
ALF: accuracy limit factor
Class: accuracy class
FS: instrument security factor
VA: power
T-meas: temperature of measurement
Seq: sequence
Ktd: transient dimensioning factor
Ts: secondary loop time constant
Kssc: rated symmetrical short-circuit current factor
Tp(ms): specified primary time constant
Seq time test (ms)

tal: permissible time to accuracy limit
t'': the duration of second current flow
t': the duration of first current flow
tal': Specified accuracy being maintained in tal'
tal'' Specified accuracy being maintained in tal''
tfr: dead time(during auto-reclosing)
V-kn: The voltage of knee point
I-kn: The current of knee point
Rct: secondary winding resistance
Eal: rated equivalent limiting secondary e .m.f
Kr: remanence factor
Lu: Unsaturated inductance
Ls: Saturated inductance
Ktd: transient dimensioning factor
ε^: peak instantaneous(total) error
Upn: rated primary voltage
Usn: rated secondary voltage